

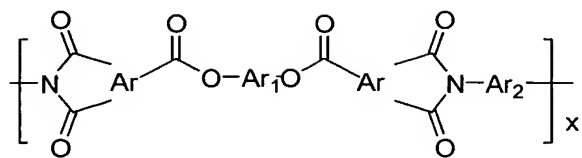
What is claimed is:

1. A process for separating one or more gases from a mixture of gases comprising the steps of bringing said gaseous mixture into contact with a first side of a gas separation membrane such that a portion of said gas mixture permeates to a second side of said membrane and a portion of said gas mixture is collected as a nonpermeate, the resulting gas mixture on said second side of said membrane being enriched in one or more components over that of the mixture on the first side of said membrane, wherein said gas separation membrane is formed from a polymer containing a main-chain ester linkage, wherein said polymer is formed by a polycondensation reaction between an acetyl chloride and a phenol in presence of a catalyst.

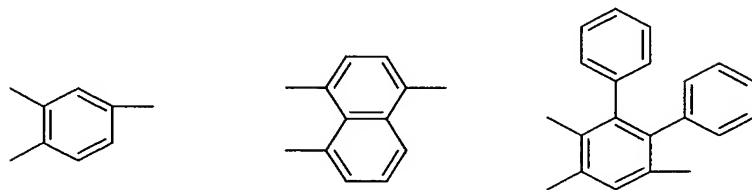
2. The process of claim 1 wherein said polycondensation reaction is catalyzed independently by toluenesulfonyl chloride, benzenesulfonylchloride, trimethylsilane chloride, and triphenyl phosphite or a mixture thereof.

3. The process of claim 1 wherein said polymer is a polyester, a poly(ester amide), or a poly(ester imide).

4. The process of claim 3 wherein said polymer is a poly(ester imide) of the following general formula:

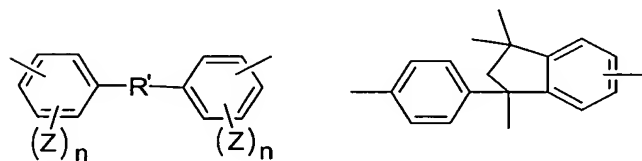
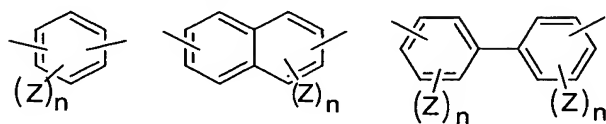


Where x is an integer larger than 10 and Ar is independently



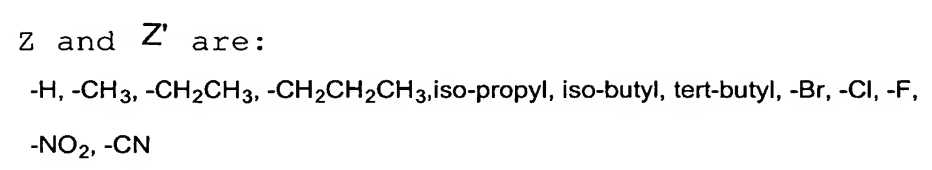
or a mixture thereof;

—Ar₁— is independently

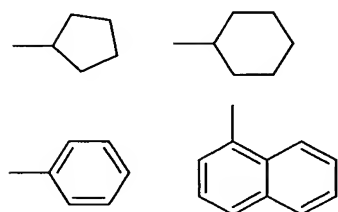


or a mixture thereof;

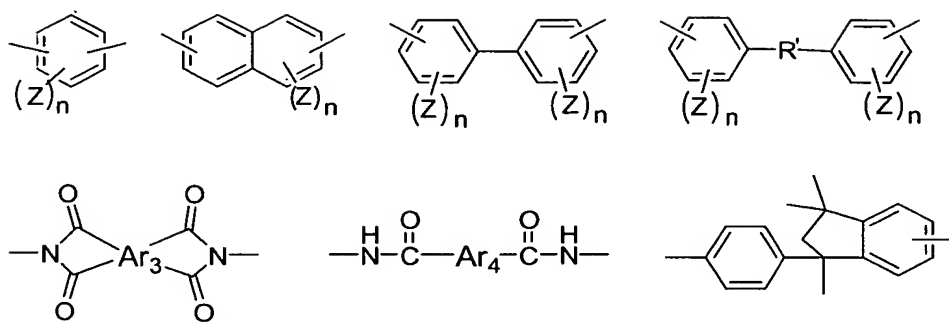
—R'— is



U. GU. GU. GU.

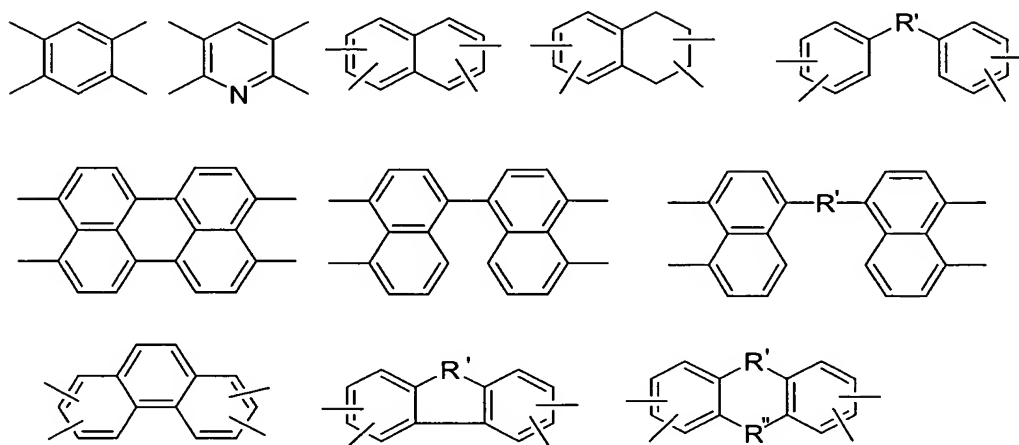
NO₂, ON
$$\Pi = 0 - 4,$$

τ is independently



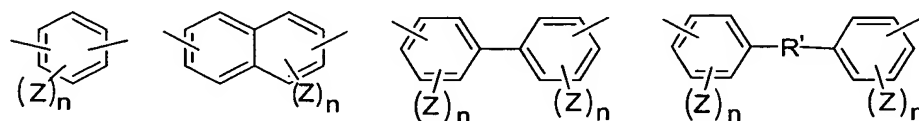
or a mixture thereof;

Where Ar_3 is independently

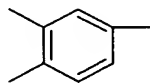


or a mixture thereof;

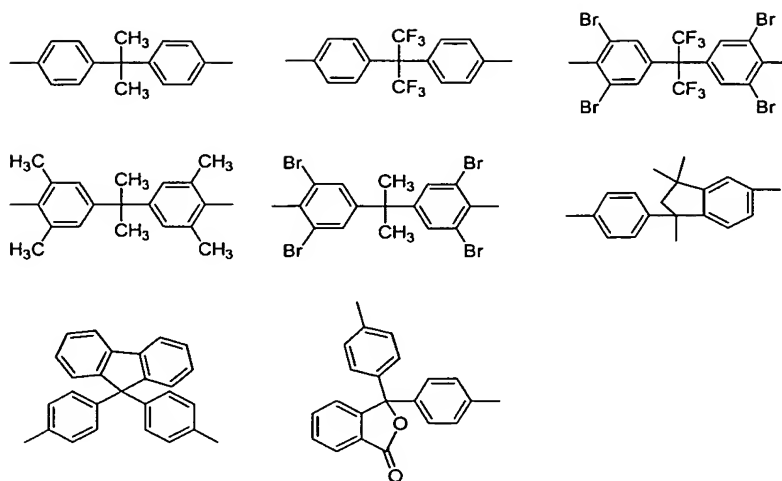
$-Ar_4-$ is



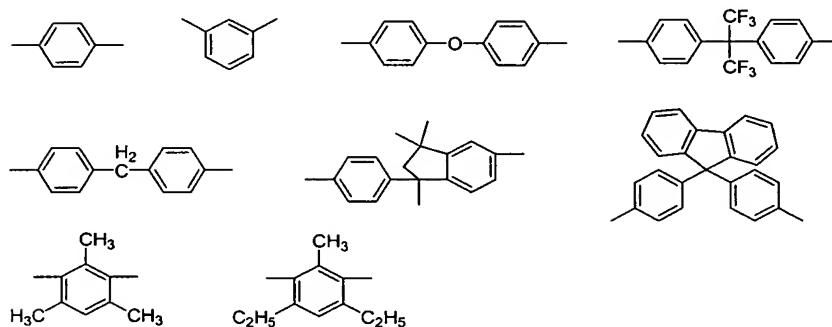
5. The process of claim 4 wherein said Ar is



6. The process of claim 4 wherein said $-Ar_1-$ is:



7. The process of claim 4 wherein said $-Ar_2-$ is:

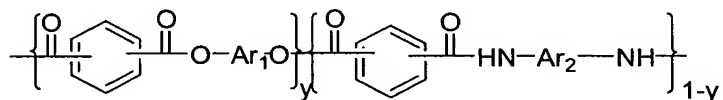


8. The process of claim 4 wherein said poly(ester imide) is formed by reacting tetrabromobisphenol A with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

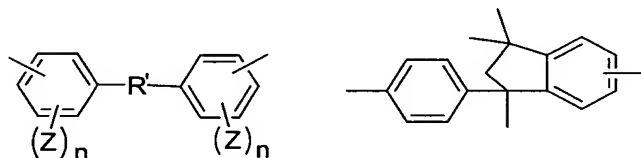
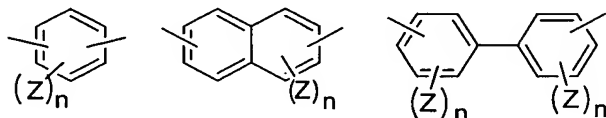
9. The process of claim 4 wherein said poly(ester imide) is formed by reacting 4,4'-hexafluoroisopropylidene bisphenol with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-

phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

10. The process of claim 3 wherein said polymer is a poly(ester amide) of the following general formula:

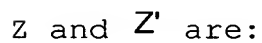


Where y is between 0.01 and 0.99 and $-\text{Ar}_1-$ is independently



or a mixture thereof;

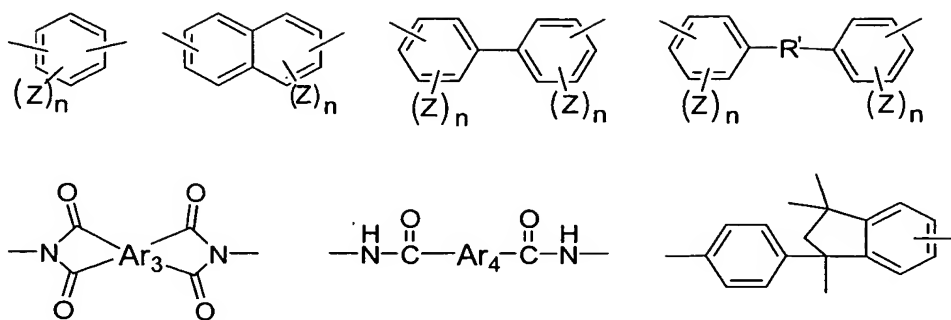
$-\text{R}'-$ is



Four chemical structures are shown, each with a substituent line:

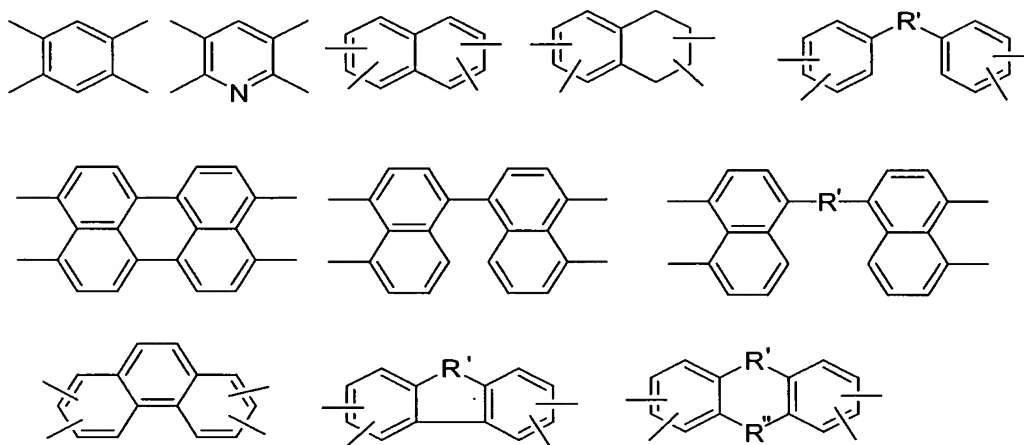
- Cyclopentane (a five-membered ring)
- Cyclohexane (a six-membered ring)
- Benzene (a six-membered aromatic ring)
- Naphthalene (two fused benzene rings)

—Ar₂— is independently



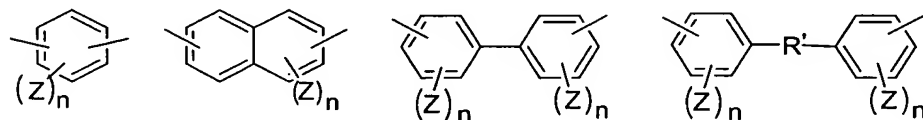
or a mixture thereof;

Where Ar_3 is independently

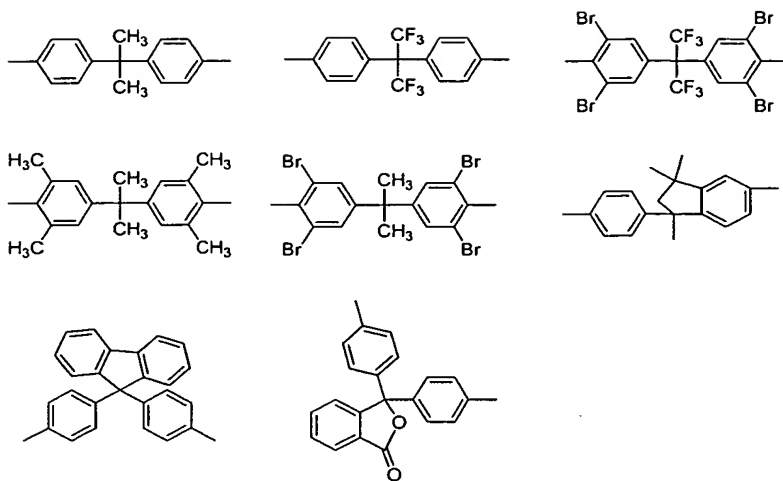


or a mixture thereof;

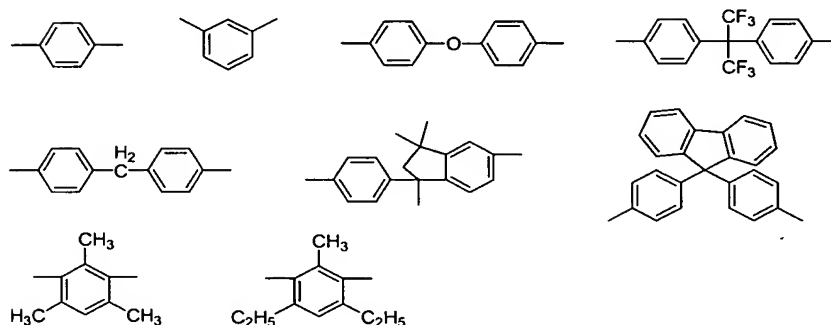
$-Ar_4-$ is



11. The process of claim 10 wherein said $-Ar_1-$ is:



12. The process of claim 10 wherein said -Ar₂- is:

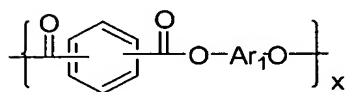


13. The process of claim 10 wherein said poly(ester amide) is formed by reacting tetrabromobisphenol A with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

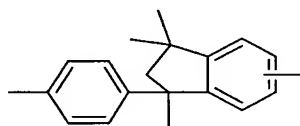
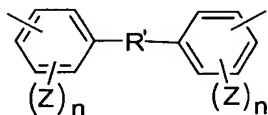
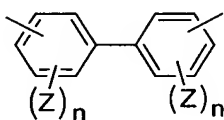
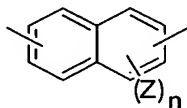
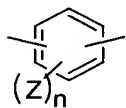
14. The process of claim 10 wherein said poly(ester amide) is formed by reacting 4,4'-hexafluoroisopropylidene bisphenol with one of the

following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

15. The process of claim 3 wherein said polymer is a polyester of the following general formula:

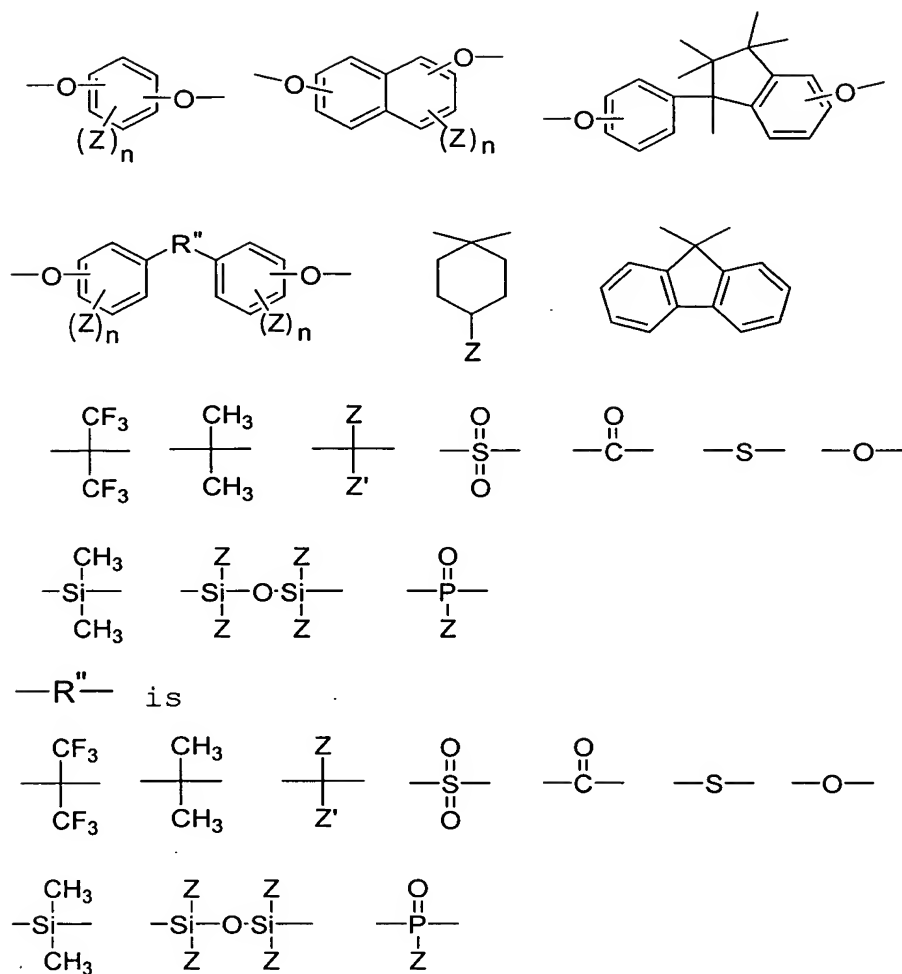


Where x is an integer larger than 10 and $-\text{Ar}_1-$ is independently



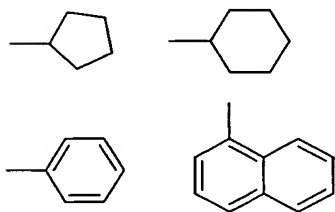
or a mixture thereof;

$-\text{R}'-$ is



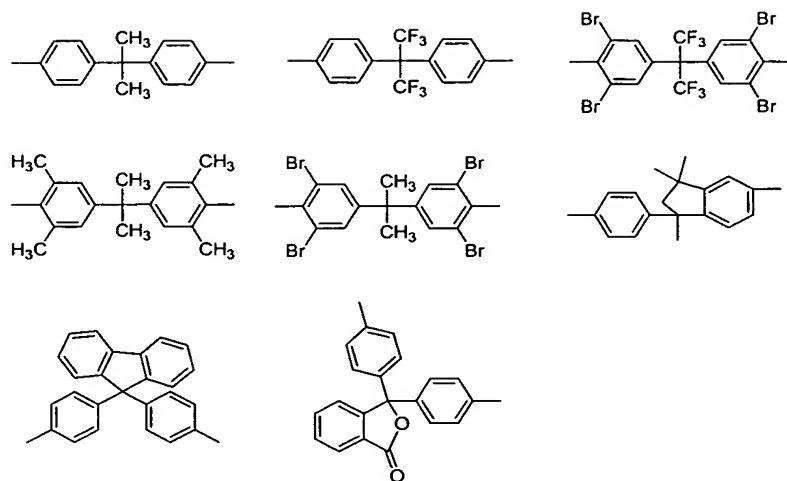
Z and Z' are:

-H, -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, iso-propyl, iso-butyl, tert-butyl, -Br, -Cl, -F, -NO₂, -CN



n = 0 - 4.

16. The process of claim 15 wherein said -Ar₁- is:

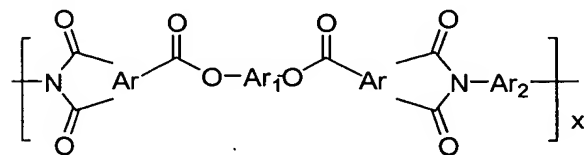


17. A polymer containing a main-chain ester linkage which is formed by the solution polycondensation reaction between an acetyl chloride and a phenol in presence of a catalyst.

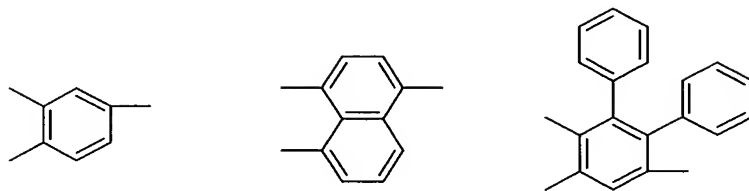
18. The polymer of claim 17 wherein the solution polycondensation reaction is catalyzed independently by toluenesulfonyl chloride, benzenesulfonylchloride, trimethylsilane chloride, and triphenyl phosphite or a mixture thereof.

19. The process of claim 17 wherein said polymer is a polyester, a poly(ester amide), or a poly(ester imide).

20. The polymer of claim 19 wherein said polymer is a poly(ester imide) of the following general formula:

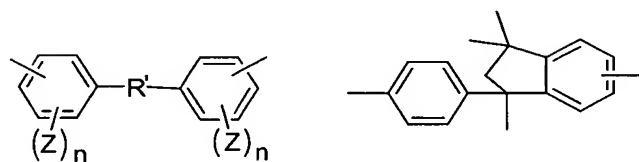
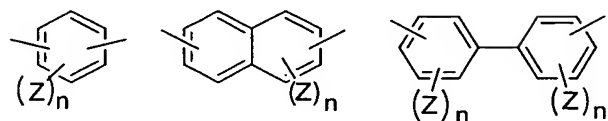


Where x is an integer larger than 10 and Ar is independently



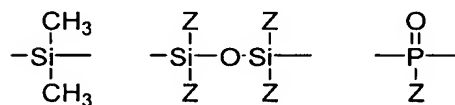
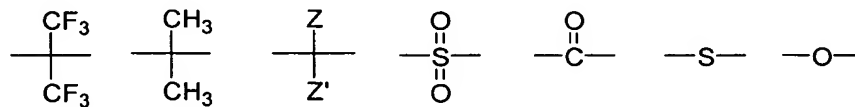
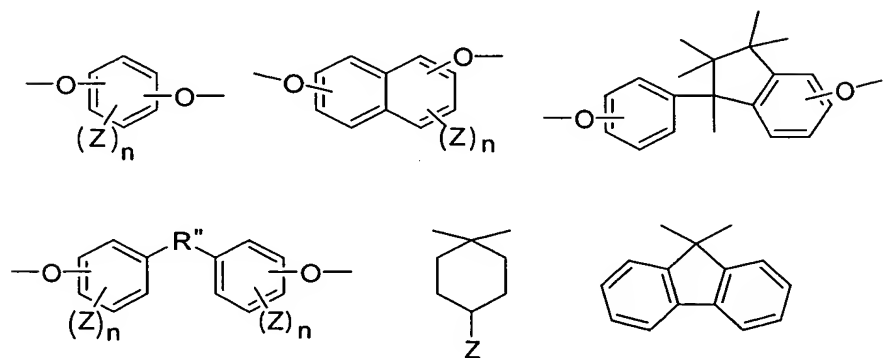
or a mixture thereof;

—Ar₁— is independently

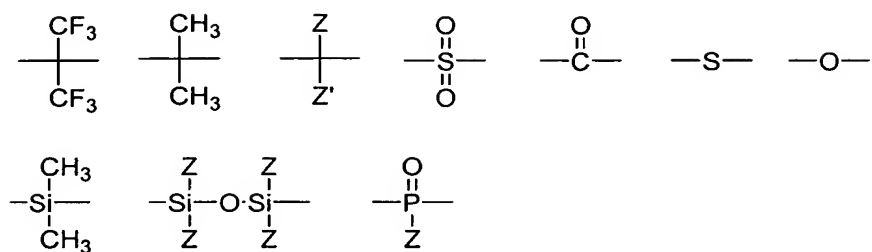


or a mixture thereof;

—R'— is

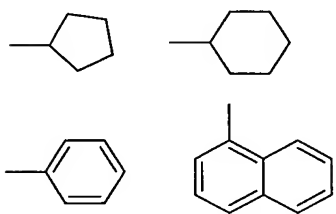


—R''— is



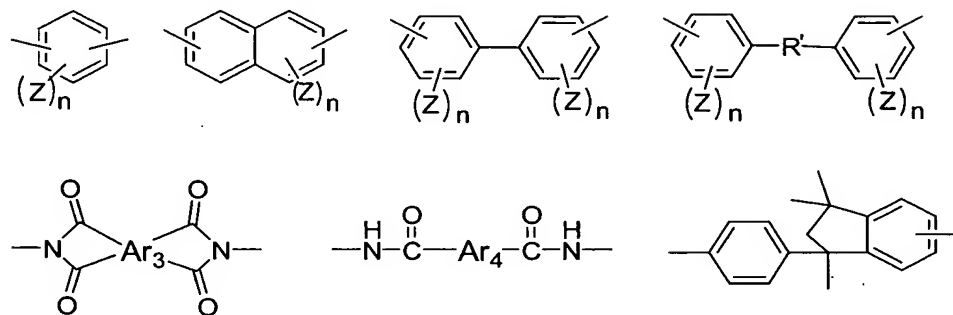
Z and Z' are:

-H, -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, iso-propyl, iso-butyl, tert-butyl, -Br, -Cl, -F,
-NO₂, -CN



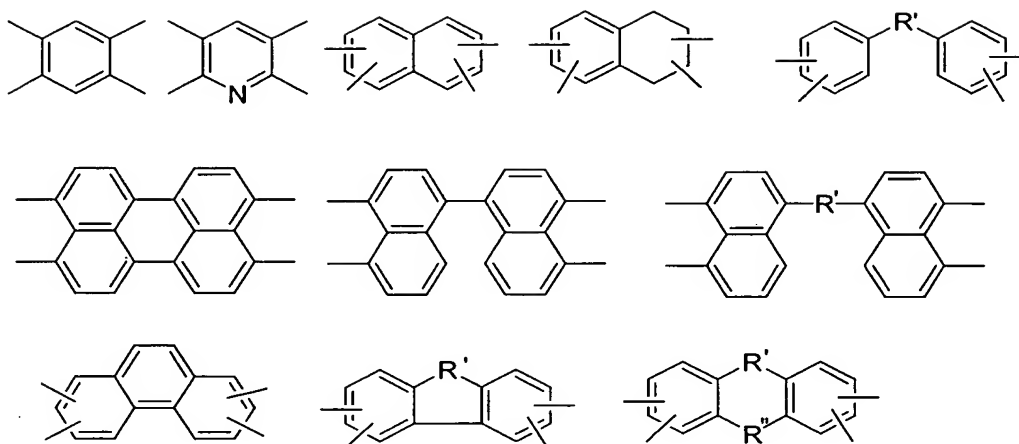
n = 0 - 4;

-Ar₂- is independently



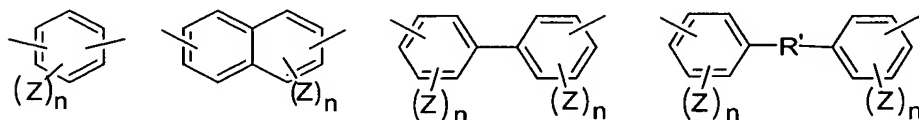
or a mixture thereof;

Where Ar₃ is independently

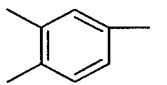


or a mixture thereof;

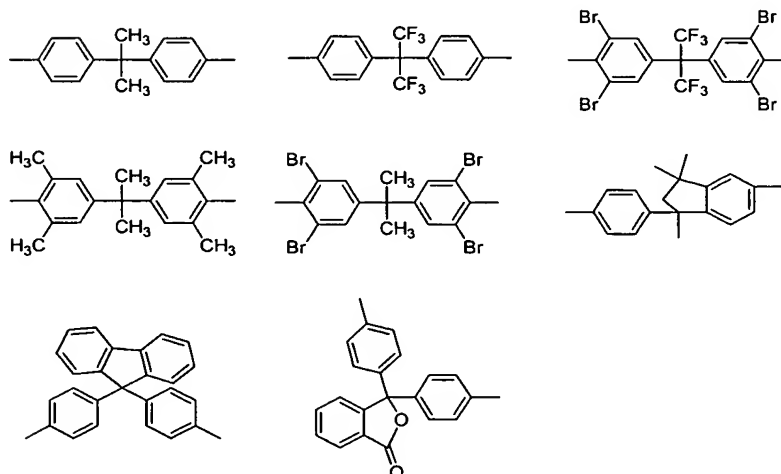
—Ar₄— is



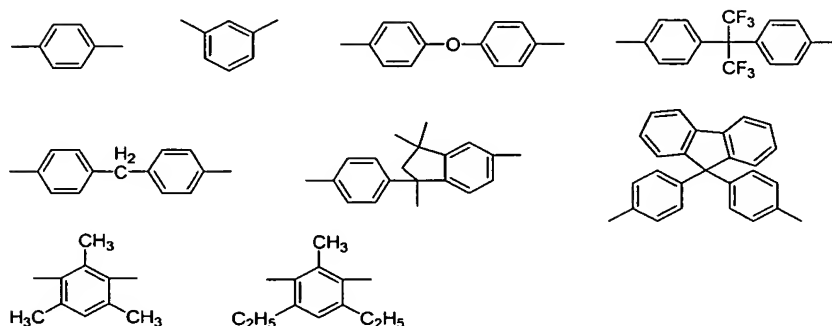
21 The polymer of claim 20 wherein said Ar is



22. The polymer of claim 20 wherein said —Ar₁— is:



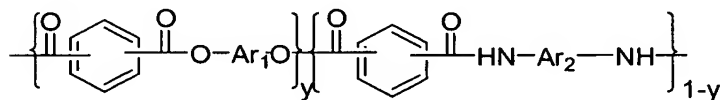
23. The polymer of claim 20 wherein said $-\text{Ar}_2-$ is:



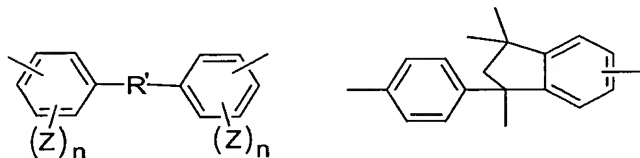
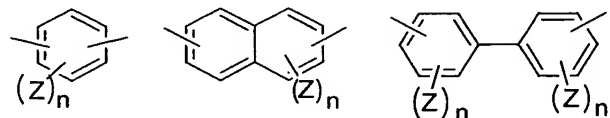
24. The polymer of claim 20 wherein said poly(ester imide) is formed by reacting tetrabromobisphenol A with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

25. The polymer of claim 20 wherein said poly(ester imide) is formed by reacting 4,4'-hexafluoroisopropylidene bisphenol with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

26. The polymer of claim 19 wherein said polymer is a poly(ester amide) of the following general formula:

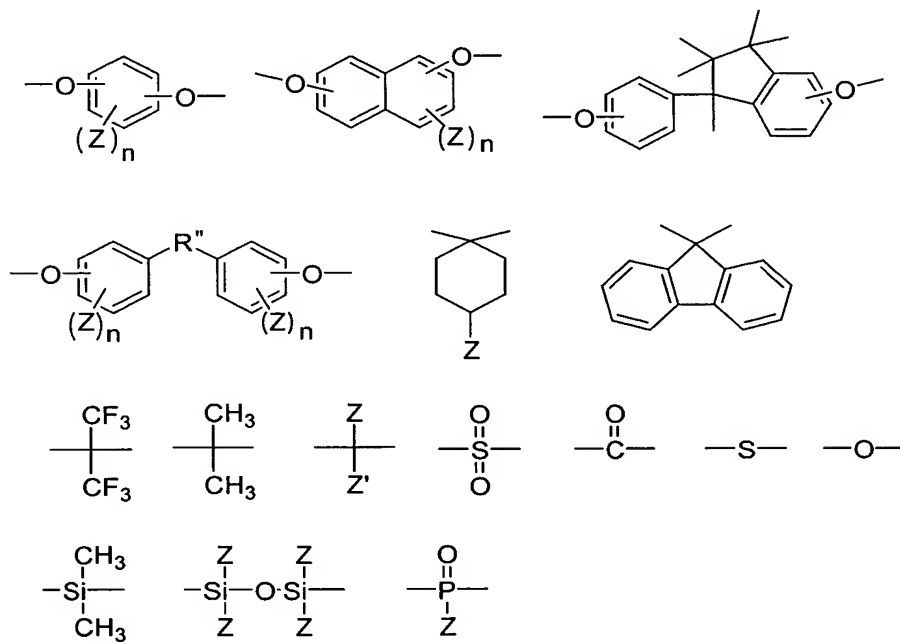


Where y is between 0.01 and 0.99 and $-\text{Ar}_1-$ is independently

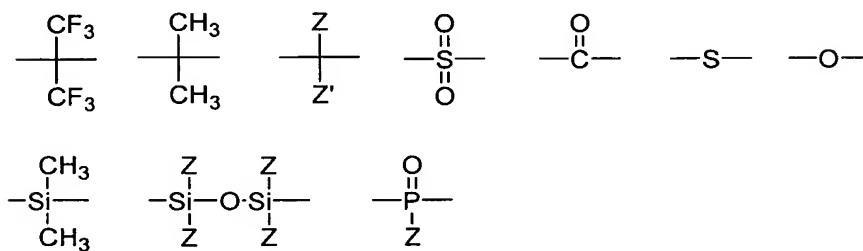


or a mixture thereof;

$-\text{R}'-$ is

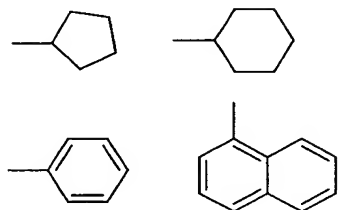


$-\text{R}''-$ is



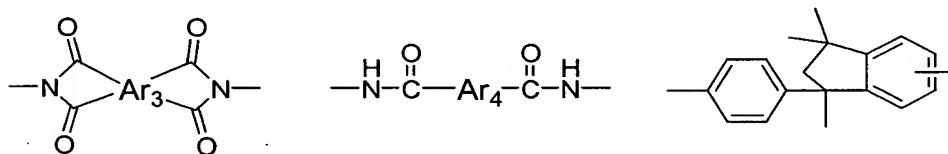
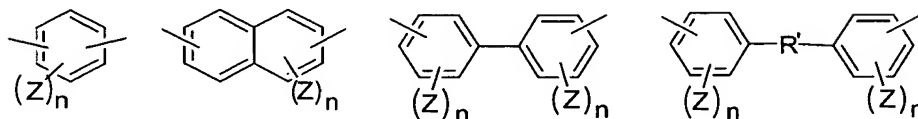
Z and Z' are:

-H, -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, iso-propyl, iso-butyl, tert-butyl, -Br, -Cl, -F,
-NO₂, -CN



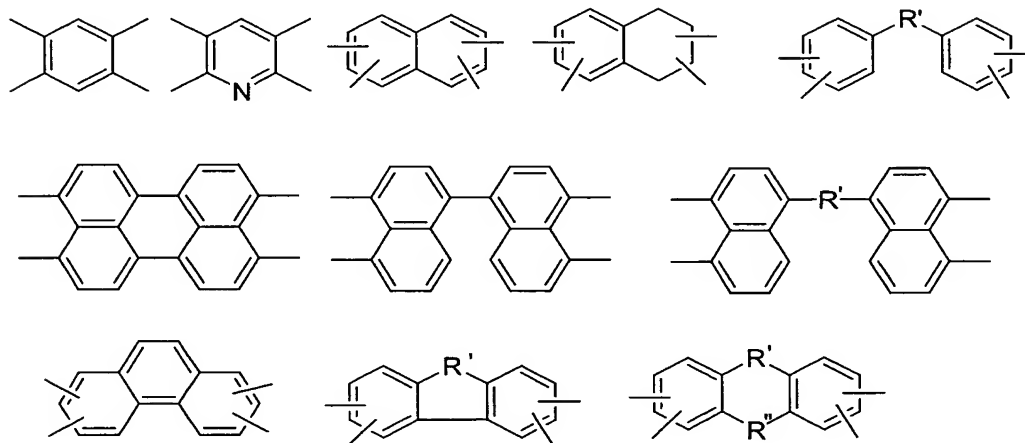
$n = 0 - 4$;

—Ar₂— is independently



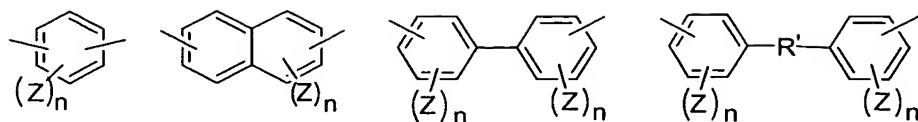
or a mixture thereof;

Where Ar₃ is independently

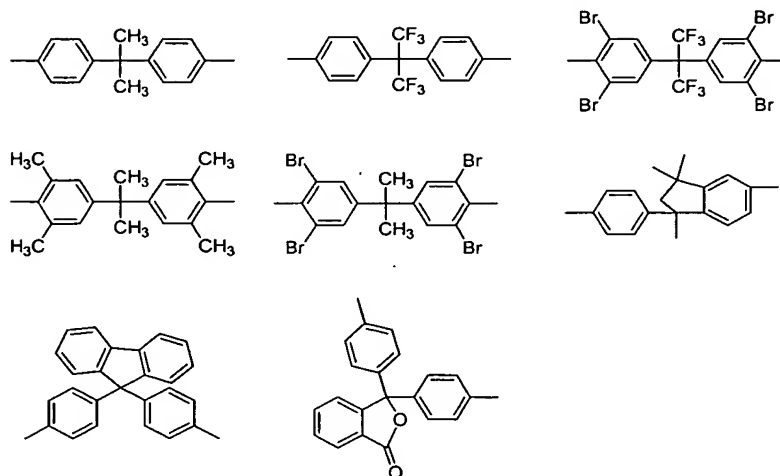


or a mixture thereof;

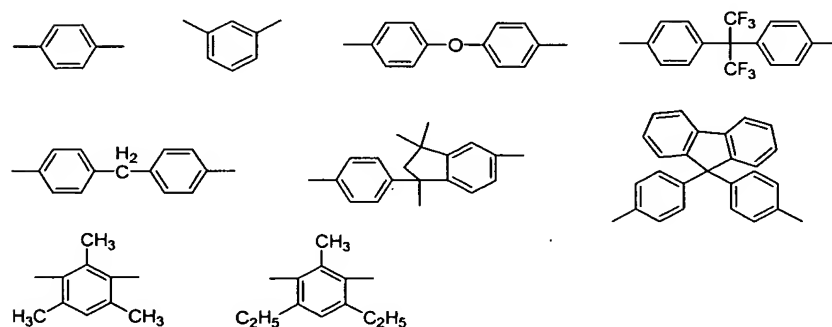
—Ar₄— is



27. The polymer of claim 26 wherein said $-Ar_1-$ is:



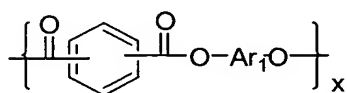
28. The polymer of claim 26 wherein said $-Ar_2-$ is:



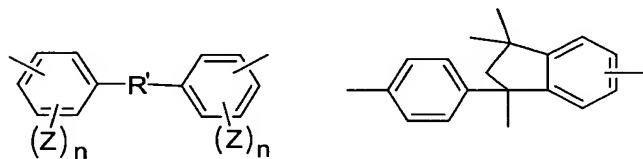
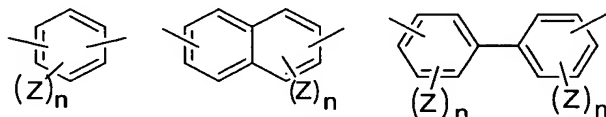
29. The polymer of claim 26 wherein said poly(ester amide) is formed by reacting tetrabromobisphenol A with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

30. The polymer of claim 26 wherein said poly(ester amide) is formed by reacting 4,4'-hexafluoroisopropylidene bisphenol with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.

31. The polymer of claim 19 wherein said polymer is a polyester of the following general formula:

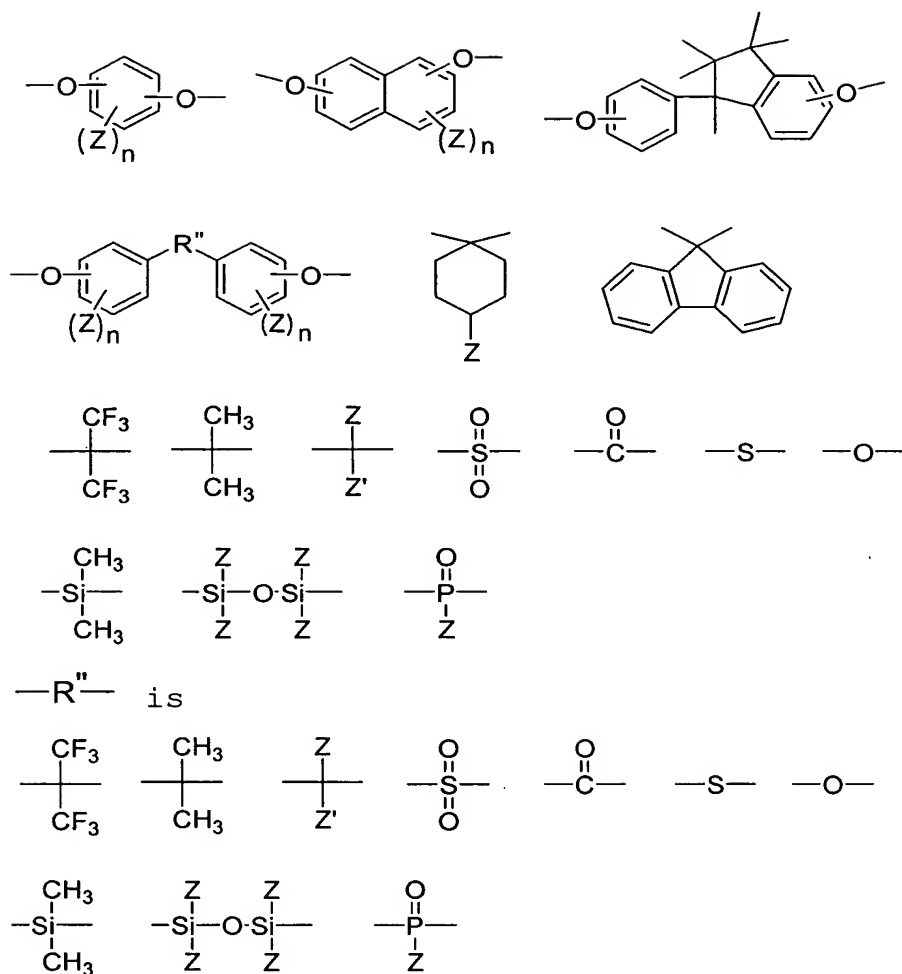


Where x is an integer larger than 10, and $-\text{Ar}_1-$ is independently



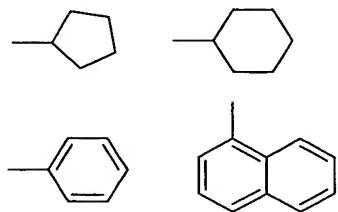
or a mixture thereof;

$-\text{R}'-$ is



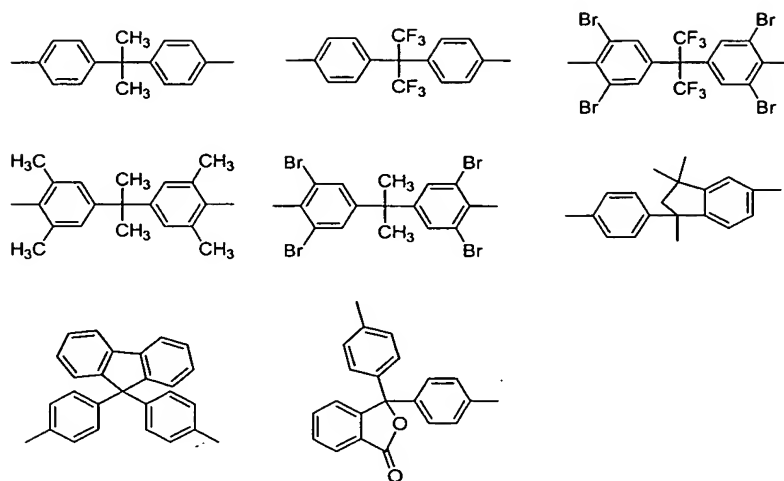
Z and Z' are:

-H, -CH₃, -CH₂CH₃, -CH₂CH₂CH₃, iso-propyl, iso-butyl, tert-butyl, -Br, -Cl, -F, -NO₂, -CN

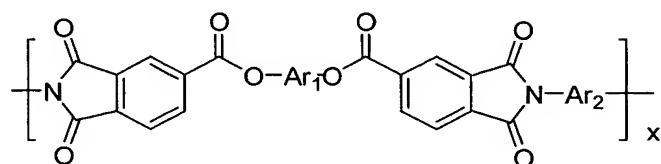


n = 0 - 4.

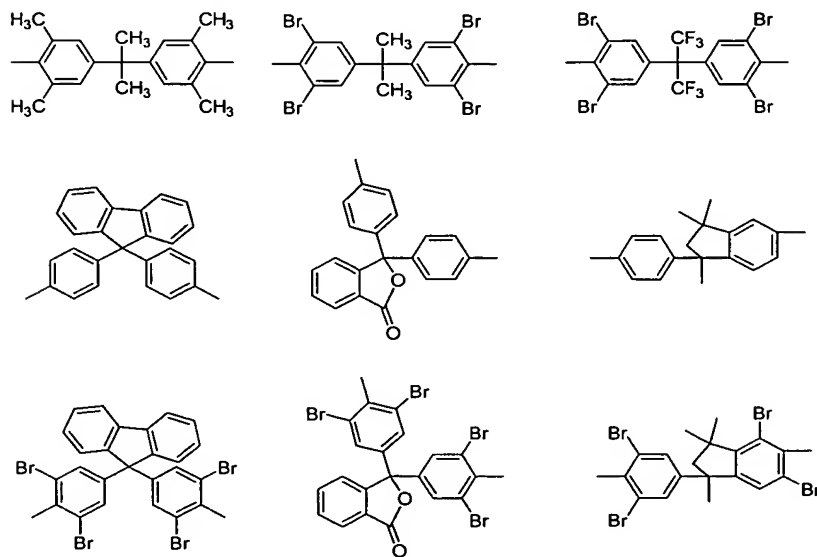
32. The polymer of claim 31 wherein said -Ar₁- is:



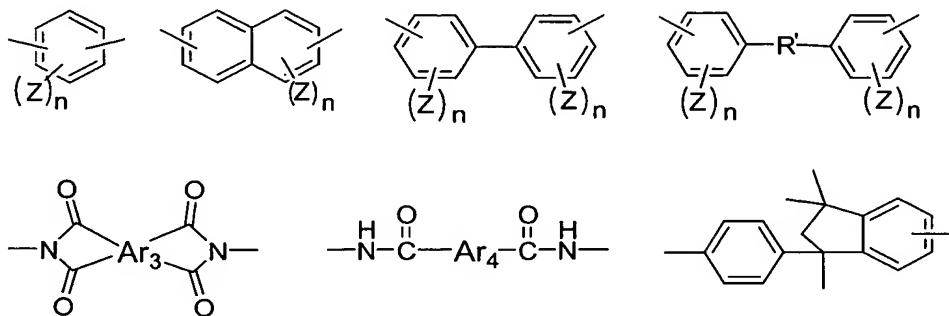
33. A poly(ester imide) comprised of chemically combined aromatic units of the following general formula:



where $-Ar_1-$ is a divalent aromatic organic radical having the following structure

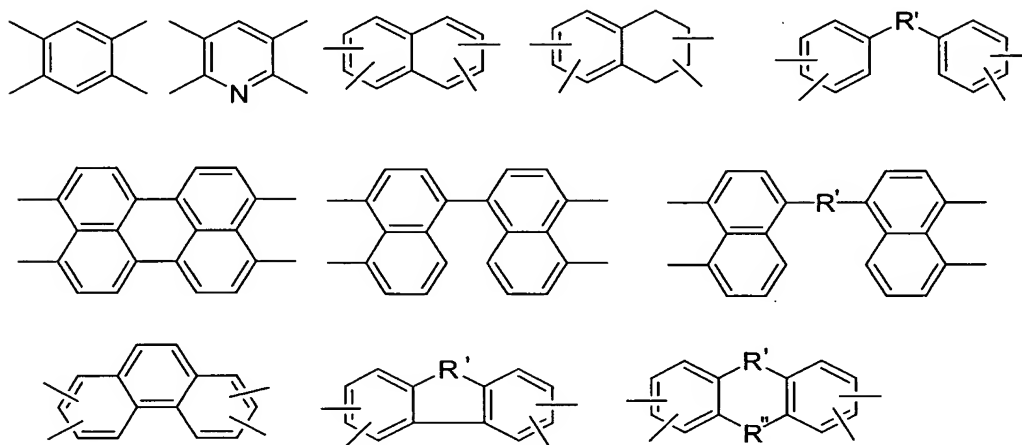


or a mixture thereof, and $-\text{Ar}_2-$ is independently a divalent aromatic radical having the following structure:



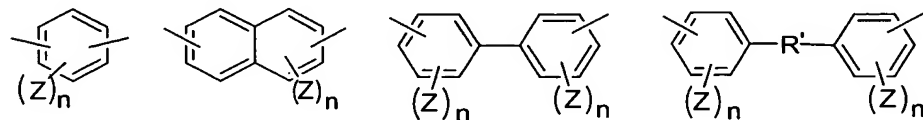
or a mixture thereof;

Where Ar_3 is independently



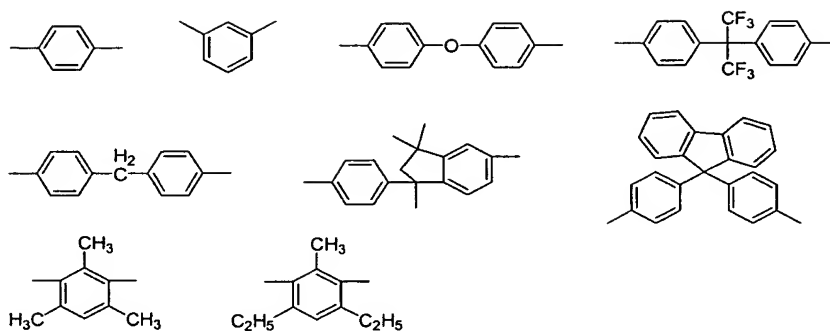
or a mixture thereof.;

$-\text{Ar}_4-$ is



or a mixture thereof.

34. The poly(ester imide) of claim 33 where said $-\text{Ar}_2-$ is



35. The polymer of claim 34 wherein said poly(ester imide) is formed by reacting tetrabromobisphenol A with one of the following dianilines: 4,4'-oxy-dianiline, 1,3-phenylenediamine, 1,4-phenylenediamine, 1,5-naphthalenediamine, 4,4'-hexafluoroisopropylidene dianiline, 2,4,6-trimethyl-1,3-phenylene diamine, or a mixture thereof.